2. PROJECT DESCRIPTION

This section describes the MARS Project proposed by the Applicant. The information in this section is intended to provide the reader with an understanding of the construction and operational aspects of the proposed Project and provide a common basis for the analysis of environmental impacts in Section 4. Some Project information that is specific to the analysis of particular issue areas is presented in those respective sections.

Section 2.1 describes the facilities proposed by the Project, including both offshore and onshore components. Section 2.2 describes the methods proposed to install and construct those facilities. The proposed construction schedule is presented in Section 2.3. Section 2.4 describes methods for inspecting and monitoring the construction and operation of the Project, particularly those methods and practices intended to avoid impacts on the environment. The ongoing operation and maintenance of the Project after construction is described in Section 2.5, and plans for the future use and eventual decommissioning of facilities at the end of the Project's life are described in Section 2.6. Required permits, approvals, and regulatory requirements of other agencies are listed in Section 2.7.

2.1 PROPOSED FACILITIES

The Applicant proposes to install and operate an advanced undersea cabled observatory in Monterey Bay that would utilize new power and communication technologies to provide a remote, continuous, high-power, large-bandwidth infrastructure for multidisciplinary, in situ exploration, observation, and experimentation in the deep sea. The MARS cabled observatory would provide researchers with long-term, real-time data access to deep-sea benthic communities and ocean processes. The Project would also serve as the engineering test bed for future cabled observatories, including the proposed North-East Pacific Time Series Undersea Networked Experiments (NEPTUNE) Project. The NEPTUNE system is a 1,864-mile (3,000-kilometer [km]) cable network that would be constructed offshore the Washington and Oregon coast. For a complete description of the Project objectives and purpose, see Section 1.1.

The Project would consist of one science node located at the end of 31.7 miles (51 km) of submarine cable extending into Monterey Bay from the shore. The science node would contain eight science data ports, each capable of providing electrical power and a 100-Mbit-per-second, bi-directional telemetry channel for data transfer. The node would have the ability to deliver a total of 10 kilowatts (kW) of power to the 8 ports. Extension cables could be plugged into any science port to provide power and communications up to 2.5 miles (4 km) away from the node. Scientific and test equipment would be installed by the Applicant using the most cost-effective deployment vehicle, including the Applicant's remotely operated vehicles (ROVs) and day boats. In the initial years after deployment, the node would support a variety of scientific research equipment and be utilized to test technologies, ROV operations, and operational management systems that would eventually be used on NEPTUNE. The Project systems would make use of the tools, techniques, and products developed over the last several decades for high reliability submarine telecommunication and military systems to ensure that this system can operate over a 25-year lifetime with minimum life-cycle cost.

The cable would be brought onshore to the proposed Shore Facility utilizing horizontal directional drilling technology (HDD). HDD is a highly specialized boring technique that would be used to drill an arc that would travel under Monterey Bay from the landing site to the location of the buried undersea cable. Shore facilities would consist of equipment housed in a 20-foot (6-m)-long ISO van (a type of shipping container built to the standards of the International Organization for Standardization) or similar structure, which is a portable structure typically used by scientists as portable laboratory space. The van would be utilized for the duration of the Project and would be placed on MBARI property located on the west side of Sandholdt Road at the road's northern terminus.

2.1.1 Project Location and Proposed Cable Route

The proposed Project would be located in Monterey Bay, California, with its onshore terminus at Moss Landing. The entire cable route and system components would be located within the boundaries of the Monterey Bay National Marine Sanctuary (MBNMS). The proposed cable route would extend from Moss Landing on the shore of Monterey Bay to the northwest, north of the submarine Monterey Canyon, and along the continental margin to the southeastern part of the Smooth Ridge (see Figure 2.1-1). Monterey Canyon is one of the largest geologically active submarine canyons along the west coast of North America. Geologic activity in the Smooth Ridge is common and the area is characterized by multiple slumps, rock falls, and debris flows. One massive slide, the Sur slide, was over 347 square miles (215 square kilometers) in area (Normark and Gutmacher 1988; Gutmacher and Normark 1993). The canyon bisects Monterey Bay just offshore of Moss Landing and runs down the continental slope (Shepard and Dill 1966; Greene 1970 and 1990; Greene et al. 1991a). The canyon branches out and forms a broad submarine fan that extends out more than 99 miles (160 km) from the shore. It is composed of at least 11 branches, several of which intersect the distal edge of the continental slope, but do not continue across the

Placeholder for Figure 2.1-1. Regional Location Map

continental shelf (Greene and Hicks 1990; Greene et al. 1991a). North of the Monterey Canyon, there is a broad bathymetric high called “Smooth Ridge” (Figure 2.1-2). The Ridge is a zone of slow uplift that separates Monterey Canyon (in the south) from the Ascension Canyon system (in the north) in the area where the Ascension Fault appears to be truncated by the San Gregorio Fault. The Project cable would terminate in a science node on the seabed of the Smooth Ridge at a depth of 2,923 feet (891 m) (see Section 2.1.3).

The Applicant selected the proposed cable route in order to place the science node in an area that provides: (1) a deep-water test bed required for testing and development of the NEPTUNE system components; (2) access to areas of scientific interest including the oxygen-minimum zone and chemosynthetic biological communities; and (3) proximity to active seismic areas. Smooth Ridge has been identified as an area of particular interest to the Applicant because it contains several active or potentially active cold seeps and is also geologically active (Figure 2.1-3). The proposed cable route was also selected to avoid restricted areas and obstructions. A number of restricted areas are located in and around Monterey Bay and the MBNMS and include military zones, i.e., naval surface and submarine exercise and firing range areas, and protected areas, such as marine reserves, anchorage areas, and shipping lanes. Obstructions avoided by the proposed route include buoys, rocks, and shoals where feasible; areas subject to underwater landslides or mass wasting events; and wrecks, dumping areas, and unexploded ordinance that would pose a risk to the submarine cable. The Project route was also selected to avoid or minimize potential impacts on important environmental resources and commercial fishing activities.

The Applicant has indicated the proposed cable route is the best route to achieve maximum burial (approximately 76 percent of the route). Further, the Applicant proposes to bury the cable to a maximum depth of 3.3 feet (1 m) to reduce potential risks to the cable from fishing and trawling activities and minimize potential impacts on marine resources. However, in some locations, the substrate is either composed of carbonate rock that cannot be penetrated by a plow or topographic features, such as small mounds and rocky outcrops, which prevent burial of the cable. The locations where substrate morphology would prevent burial of the cable are displayed in Figure 4.4-6 and listed in Table 4.4-1 (see Section 4.4). The proposed route would avoid or minimize potential impacts on sensitive natural resources, i.e., hard-bottom benthic communities, fisheries, and marine mammals, and would be the most direct route to Smooth Ridge, where the node could be placed in an area of scientific interest.

Placeholder for Figure 2.1-2. Proposed Cable Route and Science Node Location

To minimize the potential for damage to the cable after installation, as well as minimize interactions with the cable, the Applicant has indicated that the lease area requested from the CSLC would include a minimum cable buffer zone on either side of the proposed route and the science node. The minimum distance requested between the MARS cable and any other potential cable lines is twice the water depth at a given location, which would require up to 1640 feet (500 m) buffer on either side of the cable. The exception to this would be along the entrance to Smooth Ridge, where the corridor is too narrow for this requirement. The distance from other cables is intended to ensure that adequate room for cable repair operations is available should they become necessary. Repair operations typically involve the use of a grapnel to remove the broken cable. If another cable is located too close to the damaged cable, there is the possibility that the grapnel could inadvertently hook the other cable. If other cables were located in the narrow corridor along the entrance to Smooth Ridge, alternate means of cable repair would be investigated, such as using an ROV to locate and extract the damaged portion of the cable. Currently, there are no other cables in the vicinity of the proposed MARS cable route. In addition to the cable buffer, the lease area would include an additional 2.5-mile (4-km) radius around the science node (see Figure 2.1-4). This area would be required to accommodate scientific instrumentation and test equipment that could be located up to 2.5 miles (4 km) from the science node.

2.1.2 Proposed Cable

The MARS cable would have the capability to both convey electrical power from shore to the science node and to transmit data bi-directionally between the science node and shore facilities. The cable would supply up to 10 kW of power to the instruments, which represents significantly more power than could be supplied using batteries alone. The cable would have the ability to transmit bi-directional telemetry data at a rate of 1 Gigabit (Gbit) per second. Scientific data would be the typical data transmitted through the cable. The cable would consist of a single high-voltage Alcatel OALC4 cable, with a 1.1-inch (28-mm) outer diameter. It would contain a galvanized steel wire layer for armoring (see Figure 2.1-5).

Based on the location of the cable along the proposed route, three different armoring types would be used. These would consist of single armor (SA), single armor light (SAL), and lightweight protected (LWP). Each of these cable types consists of an 8-strand cable surrounded by a protective steel wire sheath.

Placeholder for Figure 2.1-3. Locations of Cold Seeps and Seismic Zones

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Placeholder for Figure 2.1-4. Location of Proposed Lease Area

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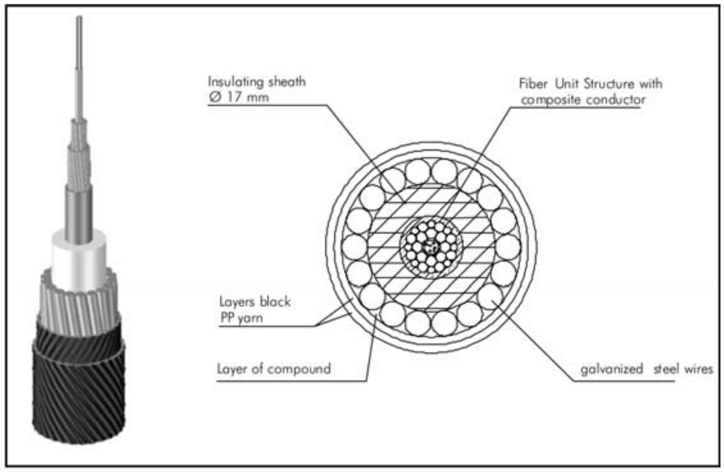
The high bandwidth and power available in the cable would allow the design of new classes of scientific instrumentation, which might later be deployed as part of NEPTUNE. Some of the highest technology risks on NEPTUNE are the 10kV to 400V converters, which would be tested on MARS.



Source: MBARI

Figure 2.1-5. Cross Section of MARS Cable.

The design and manufacture of the cable would meet all applicable National Electric Code (NEC) and National Electrical Manufacturers' Association (NEMA) standards. The shore-side design and cable terminus location would be developed by an electrical engineering firm with Professional Engineering certification from the State of California. The electrical plans would be approved by the Monterey County Planning and Building Inspection Department and the CSLC prior to construction.

The cable would be buried to the extent feasible (see the description of cable installation in Section 2.2); however, burial difficulties are anticipated along the entrance to Smooth Ridge due to substrate morphology. In areas where the route may encounter steep slope gradients, the route has been designed to run as perpendicular as possible to slopes and to avoid possible areas of sediment slump or slides. Also, to allow better control during cable-laying/burial operations, turns in the route have been kept to a maximum of 10 degrees.

2.1.3 Science Node

The purpose of the MARS cable is to supply power and bandwidth to the science node. The node would support equipment that would allow researchers to gather data from undersea instruments in large volumes for extended periods of time. The site for this node was selected in an area where science working groups would like to establish time-series instrumentation to further scientific understanding of oceanographic and geological processes. The node would be located on the seabed at the end of the cable route and housed within a trawl-resistant bottom mount to secure it to the seabed. The node measures 14.8 feet (4.5 m) long, 11.7 feet (3.6 m) wide, and 4.2 feet (1.3 m) high. The node would be deployed using an ROV at the completion of cable installation and post-lay ROV surveys (Figure 2.1-6).

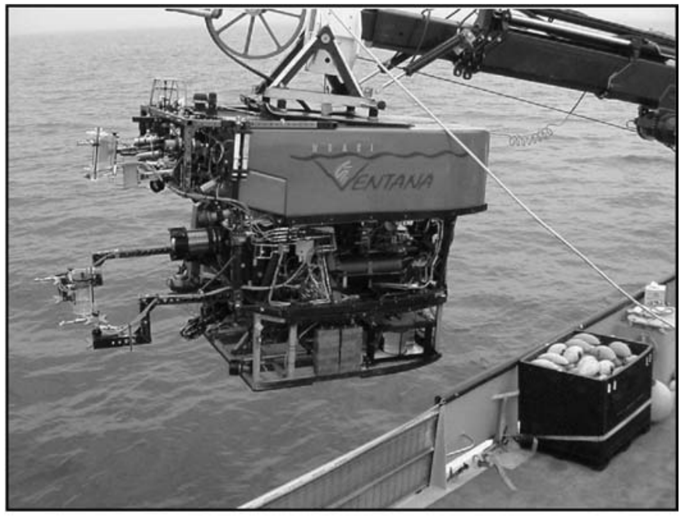

Source: MBARI

Figure 2.1-6. ROV *Ventana*.

The node would have eight separate ports (docking stations) for oceanographic instruments (Figures 2.1-7 and 2.1-8). Each port would support bi-directional data transfers of up to 1 Gbit per second and the capability to support a variety of scientific instrumentation arrayed within 2.5 miles (4 km) of the node. As the Project would provide a test bed for scientific equipment and new instrumentation and methods that would be used in future ocean observations, it is not possible to identify all the instruments that may be deployed from the node. Likewise, it is difficult to predict the exact locations or configurations of future scientific equipment and test requirements. Examples of the types of scientific instruments that might be deployed at the science node to collect data are described in Section 2.6.

2.1.4 Landing Site and Shore Facilities

The proposed landing site for the MARS cable is a vacant parcel located on the west side of Sandholdt Road at the road's northern terminus (see Figure 2.1-9). This site is owned by the Applicant and would be used to land the MARS cable and to install shore facilities at the landing location.

To bring the MARS cable to shore, a 5-inch (12.7-cm) diameter steel pipe would be installed underground that would extend out into Monterey Bay from the shore landing site. This pipe would serve as conduit for the MARS cable. The pipe would extend from the shore landing site to a point on the seabed approximately 0.89 miles (1.4 km) to the northwest of the shore landing site (see Figure 2.1-10). The pipe would be installed beneath the seabed by means of horizontal directional drilling (HDD), which is described in Section 2.2.6 below.

The power conductors and the fiber in the MARS cable would terminate at the MARS Shore Facility. The Shore Facility would include the shore power supplies, breakers, hubs, and other equipment necessary to feed power and communications to the observatory cable. The Shore Facility would be housed in a 20-foot (6-m)-long ISO van,

Placeholder for Figure 2.1-7. Diagram of Science Node

Placeholder for Figure 2.1-8. Science Node Module

Placeholder for Figure 2.1-9. Proposed Cable Landing Site and Shore Facility Location

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Placeholder for Figure 2.1-10. Proposed Directional Drilling Location

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or similar structure, placed on a concrete slab constructed in accordance with applicable building codes. Power would be supplied to the van from an existing overhead electrical distribution line adjacent to the Shore Facility site. The fiber optic cable would be installed in a conduit attached to an existing MBARI-owned fence that runs from the Shore Facility site to the MBARI research facility. The conduit is located on MBARI property and would interconnect with the MBARI laboratory through the MLML network system. MBARI has obtained permission to connect through the MLML computer network system back to Building D at MBARI's main facility, located on Sandholdt Road approximately 984 feet (300 m) to the south.

2.2 CONSTRUCTION METHODS/PROCEDURES

The Project consists of a single submarine cable that would be laid between a shore station in Moss Landing and a science node that would be placed on the seabed on Smooth Ridge. The cable would be installed utilizing a mechanical plow towed from the cable laying vessel. The maximum burial depth of the cable is related to the physical constraints of the plow and the existing soil conditions. Full burial to 3.3 feet (1 m) would be feasible in soft-bottom habitats, representing approximately 76 percent or 24.1 miles (39 km) of the sea route. Partial burial, e.g., 0.33 ft (0.1 m) to almost 3.3 ft (1 m), should be feasible in clay and dense sand habitats, comprising about 6 percent or 1.9 miles (3.1 km) of the route. No burial is expected to be feasible on rock or stiff to hard clay habitats, which represent the remaining 18 percent or 5.7 miles (9.2 km) of the route. Full and partial cable burial would prevent the cable from being affected by most trawling activities. Otter doors on a typical mud trawl may penetrate between 1 inch (3 cm) to 2 inches (5 cm) into bottom when fishing properly and up to 1.6 ft (0.5 m) if buried or allowed to fall on their side, which occurs only rarely (MBARI 2004).

The plow would cut a trench 3.3 feet (1 m) or less wide for the cable and would bury the cable in the trench. Depending on the soil conditions the plow could result in the formation of sidecast berms that vary from 3.3 feet (1 m) to 6.6 feet (2 m) in width. In areas where the cable cannot be buried with this method, the cable would be laid on the sea bottom and would be post-lay buried by jetting, where feasible. Jetting is a construction process that uses a high-pressure stream of water to excavate sediments. This system can also be utilized as a cutting tool for dense materials and compacted sediments. Some portions of the cable would remain unburied due to hard seafloor substrate and exposed rocks. In the nearshore area, the cable would be placed in a buried steel pipeline that would be installed by HDD from the shore landing site. Utilizing HDD in the near shore area reduces the potential for environmental impacts on sensitive resources by eliminating impacts from trenching across beaches and near shore areas. The steel pipeline would also ensure that the cable would not be damaged by fishing equipment, anchors, or channel dredging. The pipeline would also protect the cable from erosive sediment transport at the shore landing site. The cable would join the HDD pipe at a location approximately 0.89 miles (4,700 feet or 1.4 km) offshore at a depth of 60 feet (18.3m). Once onshore, the cable would be connected to the MARS Shore Facility described in Section 2.1.4 above.

The Applicant has contracted with Alcatel to lay the submarine cable. The Alcatel cable vessel *Ile de Ré*, or an equivalent vessel, would be utilized for the cable-laying operation (Figure 2.2-1). The *Ile de Ré's* port of entry is Port aux Francais; however, the current base is the Port of Vancouver in British Columbia, Canada. The *Ile de Ré* is a 469-foot (143-m), dynamically positioned ocean-going cable lay and repair vessel, which enables it to maintain position without the use of anchors. The vessel has twin main engines and propellers, two rudders, and full redundancy of equipment, allowing it to hold position or to continue working even in the event of an equipment failure. The vessel can remain at sea for approximately 32 days and is capable of operating in sea and weather conditions up to Beaufort 7. Sea and weather conditions defined as Beaufort 7 include winds between 28 to 33 knots with wave heights between 13.5 to 19.0 feet (4.1 to 5.8 m). The vessel is also equipped with a ROV to assist cable laying activities with a safe working depth of 8,202 feet (2,500 m). The vessel is required to comply with all national and international regulations, including MBNMS regulations on waste discharge found at 15 CFR 922.132, the ballast water management plan, disposal regulations, safety management, and U.S. Coast Guard regulations during installation of the cable.

Source: MBARI

Figure 2.2-1. Alcatel Ship *Ile de Ré*

2.2.1 Pre-Lay Grapnel Run (PLGR)

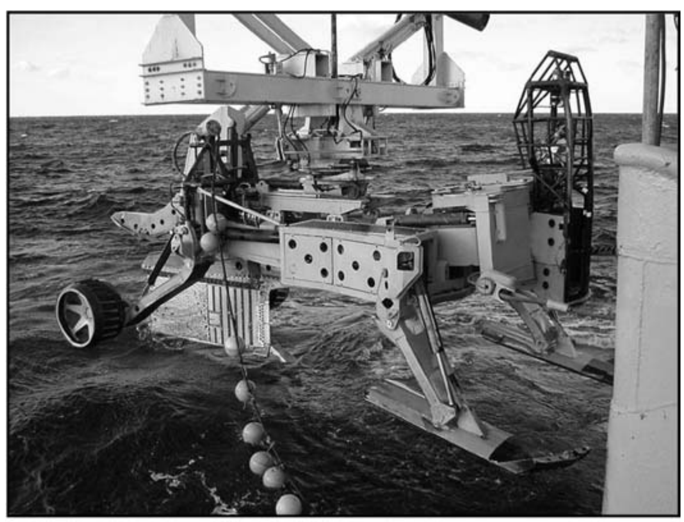
Prior to the main lay operation, a pre-lay grapnel run (PLGR) would be conducted along the proposed cable route where burial is required. The main lay vessel employing towed grapnels would carry out the PLGR. The intent of the PLGR is to attempt clearance of any seabed debris, such as wires, hawsers, abandoned fishing equipment, or other debris that may occur along the proposed route. Any debris recovered during these operations would be disposed onshore upon completion of the operations and disposed in accordance with applicable regulations.

During the PLGR operation, the vessel proceeds at a rate that ensures the grapnel(s) maintain continuous contact with the seabed. The grapnel is usually a 'sliding prong' type, which can penetrate up to 15.7 inches (40 cm) into the seabed. The grapnel is connected to the towrope or wire by means of a length of 98.4 feet (30 m) of chain with a similar length of chain following the grapnel; the chain further assists in keeping the grapnel in contact with the seabed.

As the vessel moves along the route, the towing tension is monitored and the grapnel(s) is recovered if the tension increases indicating that an obstruction has been hooked. The grapnels are routinely recovered and inspected at minimum intervals of 9.3 miles (15 km) along the route. Usually, a single tow is made along the route, but in areas where other marine activity or debris amounts are high, additional runs may be made. Completion of the PLGR operation would require approximately one to two days.

2.2.2 Main Lay Operations

The cable plow is hydraulically operated and would be towed by a towrope from the cable installation vessel (Figure 2.2-2). The cutting depth of the plow is controlled by varying the position of the skids and the angle of the plow share. The plow has a patented method of cutting through the sediment and can bury cables to a maximum depth of 3.6 feet (1.1 m) achieving 3.3 feet (1 m) of cover. Rear stabilizers can be used to assist with depth control on soft ground. The plow is fully remote



Source: ALCATEL

Figure 2.2-2. Plow Used for Cable Laying Operations.

controlled from a control cabin onboard the vessel while being towed. The plow is equipped with a vertical and lateral cable angle sensor, a sonar system used for obstacle avoidance, and a forward television camera and lighting system. Plow burial would occur along sections of the route containing suitable substrate conditions identified by the route and burial assessment surveys conducted by the Applicant. The burial assessment survey was conducted to establish the burial depth and the level of cable armor necessary to protect the cable. To facilitate cable laying operations, Alcatel intends to use Makai Ocean Engineering's software. This sophisticated system is able to model the catenary, or curve, of the cable and predict the required cable slack, thereby minimizing the risk of introducing loops in the cable system.

The surface-laid section of cable would be post-lay buried by jetting. Although the Applicant proposes to bury the cable to the maximum extent practicable, due to the presence of escarpments and carbonated substrate morphologies, between 3.7 and 6.2 miles (6 and 10 km) of cable could not be buried. Additional armoring would be installed in these areas to protect the cable.

2.2.3 Plowing Operations

The plow would be deployed and recovered by means of an A-frame structure located at the stern of the vessel. A docking-frame assembly is used to minimize any excessive pendulum motion caused by vessel movement when the plow is being handled out of the water. The plow would be launched by lifting it from the working deck and moving the A-frame slowly outboard until the plow is clear of the stern; pay out would be continued until the plow is a few meters below the surface of the sea. At this stage, the plow systems would be checked prior to transferring the weight of the plow to the towline and carefully lowering the plow to the seabed. As the plow is lowered, the plow control umbilical with attached recovery line would be simultaneously paid out.

When the plow arrives on the seabed, the cable-laying vessel moves slowly forward paying out cable to maintain tension, and adjustments are made to the tow wire and umbilical line to achieve the optimum towing scope or 'layback' for the plow. While these adjustments are made, the plow remains stationary. Just prior to the start of plowing, the tow winch rendering is set to avoid excessive towing tensions.

As the plow starts to move, the plow skids would be raised (causing the share to dig deeper into the seabed) and the depressor arm would be lowered until the required burial depth is achieved. Cable would be paid out such that the cable reaches the seabed a few meters in front of the plow. This would result in minimal residual cable tension measured at the plow. During plow burial operations, there is typically a 6.6-

foot (2-m)-wide area of disturbance along the installation route. The plow to be used for installation is capable of burial to 3.6 feet (1.1 m), down slopes of up to 12 degrees, and up slopes in excess of 30 degrees.

When the end of the plowed section is reached, the skids are lowered and the depressor arm is raised causing the burial depth to be reduced to a minimum. The cable-laying vessel is stopped and the towing scope is reduced while simultaneously recovering the umbilical and attached recovery line. When the plow lifts clear of the seabed, the cable-laying vessel would move ahead very slowly as the plow is raised to the surface. Lay cable is paid out to maintain appropriate tension. The plow would be held at a point just below the surface while the recovery line is attached to the lift wire, which passes over a sheave at the top of the A-frame. The plow is then raised on the recovery/lift line to engage in the docking frame. Finally, the A-frame is moved inboard, and the plow is lowered to the vessel's deck.

The plow is primarily intended for use in simultaneous lay and bury operations. For simultaneous lay and burial, the lay cable touches down on the seabed ahead of the plow. As the plow moves forward, it picks the cable up off the seabed and buries it. This technique is made possible by the steering mechanism, which allows the plow to track along the cable without moving it sideways across the seabed. Cables with a low submerged weight may be laid directly into the bell mouth at the front of the plow. In this mode of operation, the plow is deployed and recovered with the lay cable passing through the plow and with the tow cable and umbilical connected. The system is diver-less in normal operation. Post-lay burial operations (see Section 2.2.5 below) would require the use of an ROV or divers to load and unload the cable on the seabed.

Several factors are taken into consideration when determining cable burial depth. The most significant factor is the substrate encountered. In areas where substrate morphology prevents burial of the cable, the plow would be raised above the obstruction and cable would be paid out along the surface until substrate conditions are favorable to burial. At this point, the plow would be lowered to the sea floor and cable burial would continue. Raising the plow and surface laying cable would prevent damage to the plow and minimize potential impacts on hard-bottom communities. Cable lay and burial activities are expected to require approximately four days for completion.

2.2.4 Trawl-Resistant Node Frame Deployment

The cable would be installed from the shore landing site towards the sea. The plow would be retrieved when the main cable-laying vessel gets to within 1.2 miles (2 km) of the science node installation point. The main lay vessel would then surface lay the cable and deploy the trawl-resistant node frame on the end of a ground rope and continue surface laying the ground rope. When the trawl-resistant node frame is on the seabed, an acoustic release would be activated which would part the ground rope just above the seabed, leaving approximately 1.2 miles (2 km) of ground rope attached to the node. This 1.2-mile (2-km) section of ground rope would be recovered using the on-board ROV with a cutting tool and attaching a recovery rope to the ground rope.

After the cable and the trawl-resistant node frame have been deployed, the Applicant's Research Vessel *Point Lobos* would lower the science node onto the ocean floor near the trawl-resistant node frame. The Applicant's ROV *Ventana* would then latch onto the science node, lift it, and then lower it into the trawl-resistant node frame. The ROV would then attach the underwater mateable connectors between the node and the trawl-resistant node frame to allow the node electronics to be connected to the shore through the cable. Placement of the science node and burial of the remaining cable would require between one to two days.

2.2.5 Post-Lay Inspection & Burial (PLIB)

The cable laying vessel Alcatel would utilize a ship board ROV to conduct the post-lay inspection and burial of the cable. The ROV is capable of 3.3-foot (1-m) burial by jetting and can operate in water depths in excess of 3,280.8 feet (1,000 m). The ROV would be free flying, or tracked, and fitted with lights, cameras, depth sensor, pitch and roll sensor, heading sensor, and other appropriate fittings required to perform the work. PLIB activities would include the following:

- Inspection of the splice positions in the buried sections of the cable;
- Jet burial in the plowed sections where the plow could not bury the cable for operational reasons, i.e., excessively soft substrate conditions that cannot support the plow, steep slopes, etc.; and
- Burial and inspection of any unburied sections of the cable remaining from the node deployment operation.

The PLIB program would require approximately one to two days to complete and would closely follow that of the main lay vessel. The program is designed to minimize additional impacts on biological resources where maximum cable burial was not achieved and to reduce the risk to the exposed cable.

The proposals for PLIB assume jetting into suitable seabed materials. Rock cutting, trenching, or similar construction activities would not occur.

2.2.6 Horizontal Directional Drilling

HDD would be used to install an underground conduit, consisting of a 5-inch diameter steel pipe from shore to a point below the seafloor approximately 0.89 miles (1.4 km) offshore at a depth of 50 feet (15 m). During drilling operations lubrication would be provided using water and bentonite clay, referred to as drilling mud or fluid, to aid the drilling. In sand, which is the soil condition expected to occur at the Project site, the drilling mud would work as a grout to stabilize the sand in place and minimize the potential for the collapse of the borehole. Bentonite is a non-toxic, inert substance that provides a number of critical functions in HDD operations, including the removal of suspended solids from the borehole, cooling the drill head, and filling the annulus space in the surrounding soils. A wire line magnetic guidance system would be used to ensure that the angle, depth, and exit point conform to the engineering plans. The steel conduit in which the fiber optic cable would be placed would be advanced in sections through the borehole as it is created.

Land Survey and Drill Design. Before the HDD operation begins, the entry and exit points would be established and relative elevations and drill distances surveyed and verified. A sub-bottom profile survey of the proposed HHD route was completed by the Applicant, which did not identify any subsurface obstructions. If any utility crossings or subsurface obstructions are subsequently identified, they would be marked during this operation and avoided by altering the drill path alignment. The sub-bottom profile of the ocean floor and the proposed drill path alignment would also be used to verify the depths provided are correct and to establish a true running line and elevation for the drill path. Where possible, the locating grid would be placed along the entry portion of the drill path to verify the position of the drill head during drilling operations. At the proposed exit point, i.e., where the HDD operation proposes to "daylight" on the seabed offshore, a marine support crew would set a buoy at the exit coordinate, and this distance would then be measured and verified. The depth of the drill path recommended by the HDD contractor is -90 feet (27 m) to -100 feet (30 m) below sea level. This depth would result in a drill path approximately 56 feet (17 m) below the sea floor and is intended to hinder the release of drilling mud to the surface while remaining above unknown subterranean formations that may occur at greater depths.

Drill Site Preparation and Set-up. The proposed staging area for the HDD operation is located on the south side of the entry channel to Moss Landing Harbor near the north end of Sandholt Road (see Figure 2.2-3). This area is owned by the Applicant and would be utilized during construction of the Project. A site 100 feet by 150 feet (30 m by 45 m) in size would be required for HDD operations. Equipment would include the drill

Placeholder for Figure 2.2-3. Diagram of Typical HDD Layout

rig, mud recycling system, drill cuttings, extra drill pipe, support vehicles, and entry or sump pit. The work area would require some special preparations prior to commencing HDD operations, including the construction of a temporary concrete pad and sump pit. The concrete pad would be approximately 10 feet by 6 feet by 4 feet (3 m by 2 m by 1.2 m) and would be used to anchor and stabilize the drill rig during HDD operations. The small sump pit would be excavated at the bore entry to allow recovery of the drilling fluid returning from the borehole. The drilling fluid would be picked up by a sump pump and transferred to the mud recycler unit where the solids contained in the drilling fluid are mechanically separated. This allows the drilling fluid to be recirculated down hole and reused. Drilling activities would also require a supply of fresh water for the drilling fluid that would be obtained from a local water purveyor or other public works source.

Drilling Procedures. After mobilization and preparation of the drill rig, support equipment, and verification of relevant permit requirements, HDD operations would begin. Drilling activities would be conducted 12 hours a day and continue until the bore has been completed.

The drill rig operates on a carriage assembly that travels by hydraulic power along the frame of the drill rig. The bore proceeds downward from the surface at an angle until the desired depth is achieved. At this point, the angle is gradually reduced and the drill remains relatively horizontal as it is guided to the proposed exit point (Ariaratnum 2000). A directional monitoring device located inside the drill head directly behind the cutting bit is used to guide HDD bores. This unit identifies the direction of the drill head (horizontal and vertical) and verifies the location of the drill head during construction. The drill string would be advanced along the pre-determined drill path while drilling fluid is pumped down the inside of the bore pipe and exited through the drill head. As each length of drill pipe is installed, the steel conduit used to house the fiber optic and power cables would be advanced through the bore hole as it is created. Drilling fluid would then return to the entry point through the annulus between the outside of the drill pipe and the formation being bored.

The drilling fluid would be composed of bentonite clay and water. The clay is insoluble and made up of small particles that function as a lubricant for the drill head and pipe, a transport for the cuttings being removed from the hole, and as a sealant that fills the annulus space surrounding the drill hole. During drilling operations, it is also possible that some of the drilling fluids will be lost in unknown fractures within the formation. In cases where the fracture is lateral and subterranean, lost fluids may never surface. In other cases, drilling fluids may reach the surface, e.g., the fracture comes close enough to the surface that the pressure causes the release of drilling fluid above ground. The potential for significant losses of drilling fluids to the environment would be minimized through several measures including an evaluation of the subsurface bottom profile, the selection of appropriate drilling fluid mixtures, and routine monitoring of the bore alignment.

An evaluation of the subsurface geological characteristics of the formation under the harbor entrance were evaluated so that the most appropriate route for the conduit installation could be determined. Data from the sub-bottom profile conducted along the proposed drill route indicated that the area is composed primarily of sand and gravel and that no faults or fractures are present. These subsurface reflections indicate that the proposed HDD alignment would be located occur under a lens of sedimentary soil ranging from 6.6 feet (2m) to 13.2 feet (4m) in thickness. Based on the seismic data the proposed HDD alignment would travel through weakly consolidated sands or unconsolidated sands and gravel. Drill crews would utilize this information to determine the proper mixture of drilling mud and to make minor changes in the drill route. During drilling, the potential for losing drilling fluids to the formation would be assessed by monitoring returns of the drilling fluid to the entry point or changes in the pressure of the drilling fluid. If a loss of fluid volume or pressure is detected, drilling may be stopped or slowed to allow close observation for a surface release in the ocean. If a release is discovered, the Applicant would implement project specific mitigation measures identified in Section 4.5.4, Impact Analysis and Mitigation, and the protocols identified in Appendix H, Drilling Fluid Monitoring and Remediation Plan for Horizontal Directional Drilling.

Drill Exit. As the drill stem approaches the exit point on the ocean floor, the drilling conditions would be monitored to determine the exact location of the drill head in relation to the exit point. In order to achieve a mud free exit and minimize the potential release of large quantities of bentonite on the ocean floor, the drilling mud would be circulated out of the system by flushing the drill string with fresh water. The exact distance and time from the exit point that fresh water would be introduced into the drill string would be based on drilling conditions and not a predetermined distance. The actual bore exit would be identified by the drill crew when the bottom-hole assembly is no longer supported by the soil and the angle of the drill string changes dramatically. A marine support crew would be dispatched to dive on the exit to verify the exit point. Once the exit has been verified, an on-site inspector would be given the true offshore exit coordinate for approval.

Remove Bottom-hole Assembly. Once the exit location has been approved, divers would jet down through the sediment to a point approximately 2 feet (0.61 m) below the sea floor and cut off the drill steel at the desired depth using underwater cutting equipment. Once the pipe is cut and the end of the pipe has been de-burred to remove any sharp edges, the guidance wire would be removed and a pipe pig attached to an aircraft cable would be installed at the onshore end of the drill pipe. The pipe pig would be hydraulically pushed through the drill pipe with fresh water with the cable trailing the pig. This removes any remaining drilling fluids, proofs the pipe, verifies the inside of the pipe is clean, and provides a cable for pulling the fiber optic cable through the drill pipe. A “Tide Flex” check valve and a bell mouth would be installed on the offshore end of the drill and any extra cable would be pushed into the land portion of the drill pipe. The cable would be tied off to a cap that would be placed on the land portion of the drill pipe. A locator ball would be placed above the cap and the pipe would be buried according to specification. The locating ball would be used to relocate the pipe casing prior to installation of the fiber optic cable.

Site Clean-up. Once the drill is complete and the temporary pull-line installed, the pipe would be capped and back-filled and the drill site would be de-mobilized. The work area would be returned to its original condition. Excess drilling fluid and sediment excavated during the drilling operations would be removed from the collection pit and transported to an approved disposal site. The concrete anchor used to stabilize the drilling rig would be broken up and removed from the site and any excavation back-filled.

2.3 CONSTRUCTION SCHEDULE

Construction of the Project includes several components, including trenching for cable burial, installation of the cable landing pipe by HDD, and construction of onshore facilities. Installation of the cable and node is planned to occur sometime between September 1 and November 15, 2005. The total estimated installation time for cable laying is 5 to 6 days; however, weather conditions and other difficulties could increase the time needed to complete the installation. For the purposes of analysis, an installation timeframe of 10 to 14 days has been assumed for completion of all cable laying activities. Cable laying operations would occur continuously for 24 hours per day during this period. HDD activities would require about two weeks.

During cable laying, handling of large equipment, such as the sea plow or the node, would only take place in good weather with a reasonable weather forecast in prospect. Beaufort 5 is likely to be the upper limit for handling these pieces of equipment and the ROV, although swell height and period would also be considered when deciding whether to commence operations. During Beaufort 5 conditions, winds range from 17 to 21 knots with wave height between 4 to 10 feet (1.2 to 3 m). In more extreme conditions, cable operations would be suspended and the vessel put on a best-weather heading. In the worst case, if weather conditions continue to deteriorate, then the cable would be laid down with ground rope to facilitate recovery and the vessel would then seek shelter. The ship's Master has the authority to determine critical conditions and suspend work operations when needed.

2.4 ENVIRONMENTAL COMPLIANCE INSPECTION AND MITIGATION MONITORING

The Applicant has committed to implementing the following measures to avoid or minimize potential environmental impacts during installation and operation of the cable and Shore Facility. These are:

- In areas where the route may encounter steep slope gradients (8-10 degrees or greater), the cable will be placed as perpendicular as possible to slopes and avoid possible areas of sediment slump or slides.
- In areas where cable burial is not possible, additional cable armoring will be used and fishers will be notified of locations of exposed cables.
- A minimum 500-foot (152-m) safety zone along the proposed cable route will be established during installation to avoid marine mammals.
- Two NOAA Fisheries-approved marine mammal monitors will be on watch on each vessel (cable-lay and support vessels) during cable laying activities to ensure that any marine mammal entering the established (minimum) 500-foot (152-m) safety zone is sighted. If marine mammals are sighted within the established safety zone, operations will be delayed until they move out of the area.
- Cable-laying vessel speed limits of generally less than 2 knots will be established and enforced. Smaller support vessels will also be required to maintain moderate speeds (3-5 knots) during installation, operation, and maintenance activities to minimize the likelihood of collisions with marine mammals and sea turtles.
- Vessel operators will reduce or minimize propeller noise (through reduction of vessel speed) and other noises associated with cable laying activities.
- The amount of external lighting will be minimized at night and lights shielded downwards in order to minimize marine bird-vessel collisions.
- A site-specific Spill Prevention Control and Countermeasure Plan will be developed and approved prior to and implemented during all cable laying and operation/maintenance activities.

- A fast response vessel will be available during installation with an absorbent boom for spill control.
- Grapnel retrieval near outcrops will be avoided by consulting charts and relocating repair to soft substrate.
- In the event that a repair in a heavily fished area is necessary, the cable operator will notify fishermen and a local fishing vessel will be chartered to act as liaison and patrol the area to minimize the possibility of interference with fishing operations.
- Plastic barriers will be placed under the drilling equipment and oil absorbent blankets around hydraulic components to add protection between the rig and ground surface in order to contain any spill if a catastrophic failure occurs.
- Prior to HDD operations, construction personnel shall attend an environmental training session conducted by the Environmental Monitor.
- Once all the HDD equipment is in place, silt fence and hay bales will be put in place around the work perimeter and around the sump pit and mud system. Most of the erosion control will be installed after all equipment is in place so any necessary movement during the set up process will not be impeded.
- During the HDD operation, as each joint of pipe is set onto the drill rig, a visual inspection will be performed to make sure no debris is sent down the pipe that could cause a problem during cable installation.
- During the HDD operation, the drill path will be constantly monitored for surface releases by an Environmental Monitor and constant communication between the monitoring vessel and the control cab will be kept at all times. The monitors will be kept constantly informed of the progress of the drill head so as to be able to concentrate their search for any indications of an inadvertent release of drilling fluids.
- In the event of a subsurface release, divers equipped with specialized water lifts (pumps) and filter bags will be used to remove bentonite from the sea floor.
- In the event of a bentonite release on land, the release will be immediately contained and the fluid transferred back to the drill site for reuse or into a storage tank and removed from the site.
- Once the HDD operation is complete, the work area will be returned to its original condition or better to the satisfaction of all permitting agencies, public works inspectors, and supervising engineer.

- The Applicant will notify the Moss Landing Harbor District to ensure they are aware of the timing of the cable laying operations and will work with the District to provide notice of the cable laying operation to vessels that operate out of Moss Landing Harbor.

The Applicant would also comply with all applicable Federal, State, and local laws, ordinances, and regulations during both installation and operation of the Project. These requirements are discussed in Sections 4.1 through 4.9.

In addition to existing regulations and requirements, mitigation measures are proposed in this EIR/EIS to avoid or minimize potentially significant adverse impacts. These measures and the impacts they are intended to address are fully described in Section 4. The mitigation measures proposed in this EIR/EIS that are adopted by the lead agencies (CLSC and MBNMS) would become required conditions if the Project is approved. The Applicant would be required to fully comply with all of these measures during Project construction and operation, as applicable, and the lead agencies would be responsible for ensuring proper compliance with adopted mitigation measures by the Applicant. Specifically, section 21081.6 of California Public Resources Code requires the CEQA lead agency to adopt a reporting or monitoring program designed to ensure compliance with mitigation measures during project implementation. These measures must be fully enforceable through permit conditions, agreements, or other means. The required Mitigation Monitoring Program (MMP) for the proposed Project is presented in Section 6.

2.5 OPERATION AND MAINTENANCE

2.5.1 Normal Operations

Normal operation of the Project would consist of the ongoing installation, monitoring, and removal of miscellaneous types of scientific equipment and instrumentation deployed on the seabed within a 2.5-mile (4-km) radius of the science node. Equipment would be installed by the Applicant using ROVs and the Applicant's day boats. The node would support a variety of scientific research equipment and be utilized to test technologies, ROV operations, and operational management systems that would eventually be used on NEPTUNE. The deployed instrumentation and equipment would be attached to the ports on the science node in order to be supplied with power and to transmit data between the node and the shore. Researchers and scientific working groups would gather data from these undersea instruments for scientific research and testing.

The specific types of instruments and equipment that would be deployed over the life of the Project cannot be accurately predicted at this time. At any one time, multiple pieces of instrumentation and equipment could be connected to the science node for multiple independent purposes. The schedule for changing out the instruments and equipment depends on the purpose of the instrumentation, and specific timeframes or durations for these activities cannot be predicted. Individual pieces of equipment and instrumentation could be deployed for weeks or years depending on their purpose. The equipment and instrumentation would be removed using the same range of techniques available for their deployment, including use of ROVs. For information on possible future uses of the Project, see Section 2.6.

2.5.2 Repairs and Maintenance

The science node has been designed to allow repairs without disturbing the cable. Virtually all of the communication and power electronics components are housed in a central node that can be removed using the Applicant's ROVs without disturbing the cable and the trawl-resistant frame. After the ROV disconnects the underwater connectors between the trawl-resistant bottom mount and the node, the ROV can bring the node, which is nearly neutrally buoyant, to the surface where it can be transported to the Applicant's shore facilities for repair or maintenance.

The cable would be buried to the maximum extent possible along its route, thereby providing protection for most of its length. The cable would not need planned maintenance during its life and cable repairs would only be necessary if the cable is disturbed and damaged by fishing, anchoring activities, or natural events such as slumping.

Periodic inspections of the cable would be made by ROV, particularly in critical locations, such as along the neck of Smooth Ridge, where burial would be most difficult. Inspections would also occur if there is a loss of power or communication to the science node or if fishing gear is reported lost in the vicinity of the cable. Other representative sections of the cable would be inspected periodically along the route to ensure that burial is maintained and that no damage has occurred.

If the cable is damaged, repairs would be undertaken in the normal manner for submarine cables. Diagnostics within the power system itself and other optical measurement would allow the location of the fault along the cable to be determined. A cable ship would be brought in to repair the cable. If the cable can be brought to the surface without cutting the cable, the cable would be retrieved with a grapnel and brought on board for repair. If not, the cable would be cut and then each end brought to the repair vessel in turn for diagnostic measurements. The first section would be tested to determine if the fault lies in that section. If the fault is found in this first section, the faulted section would be replaced with a new section of cable. The new section of cable would contain enough additional length of cable to provide access for surface repairs and splicing to the second section. The end of this new section of cable would then be spliced on board the repair vessel to the second section that did not contain the fault. The cable, including the new spliced section, would then be re-laid. If the cable were previously buried, it would be buried to the maximum extent possible using an ROV jetting tool.

The repaired cable would then be surveyed in the same manner as it was during the initial cable installation. All adopted mitigation measures for cable installation in this EIR/EIS would be implemented during cable repair operations.

2.6 FUTURE PLANS AND REMOVAL

The proposed Project would be a test bed for new instrumentation and methods that are planned for use as part of the NSF's ocean observatories program. Scientists and engineers would submit proposals to the NSF regularly over the 25-year lifetime of the MARS observatory to design and test new instrumentation and methods on MARS.

Because its use and operation are fundamentally different from telecommunication projects, it is not possible to describe all of the instruments that would be used during its lifetime. However, there are two main categories of instrumentation that would be used to collect data in the MARS system: (1) experimental scientific instruments that have not been developed yet, and (2) typical scientific instruments that have already been developed and are used routinely.

The Project offers a new and unique platform for data collection and retrieval and would provide researchers with technology that has not previously been available. The high bandwidth and power available with the Project would allow the design of entirely new classes of instrumentation. Therefore, it is not possible at this time to describe data that may be collected for these instruments. Examples of possible types of instrumentation that may be used in association with the Project, and descriptions of some typical instruments currently in use and the type of data collected by these instruments, are presented below:

- **Acoustic Doppler Current Profiler (ADCP).** An ADCP measures the speed and direction of ocean currents. Acoustic, or sound generated impulses, are received from four different directions. The current direction is then computed using mathematical formulas to convert the return signals to standard North-

South, East-West coordinates. These data can help scientists determine how organisms, nutrients, and other biological and chemical elements are transported throughout the ocean.

- **Conductivity, Temperature, and Depth (CTD).** As the name implies, the primary function of this instrument is to detect how the conductivity and temperature of the water column changes relative to depth. Conductivity is a property that allows the passage of electrical current. The data are used to determine salinity of the seawater. It can also collect data on pressure. Data for a variety of different engineering units may be obtained.
- **Backscattering Sensor and Fluorometer.** These instruments are used to detect and differentiate particulate matter, including sediments and chlorophyll. The sensor operates at two wavelengths and measures the backscattering coefficient at these wavelengths.
- **Acoustic Current Meter.** A current meter is used to calculate the current velocity by taking measurements across four acoustic axes to provide a vector-averaged velocity measurement using the travel time differential.
- **Vertical Profiler.** A vertical profiler functions as an autonomous instrumented platform designed to collect a long series of in situ oceanographic profiles. A vertical profiler will typically carry sensors such as CTDs and current meters, although additional sensors can be added. The profiler follows a programmed trajectory along a vertical mooring cable, automatically sampling the water column and logging results. Profiles can span the full depth of the water column. The type of data collected will depend on the sensors included.
- **Guralp Broadband Seismometer.** This instrument is used to gather seismic data over the complete seismic spectrum. Data collected thus far have been combined with historical data from land-based arrays to improve determinations of the location of earthquakes and focal mechanisms. Data are currently processed at the Berkeley Digital Seismic Network. New MARS technology would allow immediate return of data and a regular power supply, providing opportunities for more sophisticated sensors and eliminating the need for frequent battery changes. Additionally, equipment problems could be detected instantly, rather than when data are downloaded up to 3 months after deployment, which is the current situation.

The Applicant currently operates under a permit with the MBNMS for those activities that have only negligible short-term adverse effects on Sanctuary resources. This permit is for activities that are otherwise prohibited in the MBNMS. This permit allows the Applicant to operate its science and engineering programs in the MBNMS. The Applicant plans to seek permission from the MBNMS for the deployment and recovery of all future Project instruments in the same manner it currently uses for existing instrumentation. In the past, the MBNMS determined that MBARI research projects were categorically excluded from the requirement to prepare an environmental assessment or environmental impact statement as they were an “action of limited size or magnitude”. Since MBARI is unable to identify what future classes of instrumentation would be used on the proposed cable, the MBNMS will determine the appropriate future environmental review and analysis at that time.

At the end of the Project’s life, the cable and node would be removed. However, the exact type of equipment that would be used to remove the cable is not known. Cable removal activities would likely require the use of diesel-powered cable-pulling equipment located at the Shore Facility location and a dynamically positioned ocean-going vessel to control the cable excavation, sectioning, and retrieval activities.

During cable removal activities a ROV and/or grapnel would be used to locate, cut, and attach a retrieval line to the cable on the seafloor. In soft-bottom areas, cable buried near the sea floor surface would be excavated by an ROV using a water jet. Once excavated, the cable would be severed at appropriate lengths and brought to the surface by the retrieval vessel. Cable that remained on the surface of the sea floor would also be severed and brought to the surface in sections. In hard-bottom areas, cable that was originally laid on the surface, and which has not been encrusted or overgrown with biota, would be severed at appropriate lengths for recovery using a ROV. In contrast, cable that was substantially encrusted/overgrown and effectively "cemented" to the bottom would be recovered to the extent feasible using a ROV to pull on the cable and attempt to cut and recover the sections. The remainder of the cable that was laid in conduit would be drawn from the shoreline onto a cable reel. A vessel similar to that used for installation would be used to reel in the cable. Cable removal activities would require approximately 20 days to complete.

2.7 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

This EIR/EIS is intended to satisfy the environmental review requirements for the proposed Project pursuant to the CEQA and the NEPA. The CSLC and MBNMS decision-makers will consider the information contained in the Final EIR/EIS before taking any action to approve or deny the proposed Project. In addition to these approvals, the proposed Project would be subject to the agency permits and approvals listed in Table 2.7-1. The Final EIR/EIS is intended to provide the CEQA/NEPA review for all required permits and approvals needed to construct, operate, maintain, and remove the Project.

Table 2.7-1. Required Permits and Approvals

Agency	Permit/Authorization/Consultation
Federal	
Monterey Bay National Marine Sanctuary (MBNMS)	Research Permit under the National Marine Sanctuaries Act
National Oceanic and Atmospheric Administration (NOAA)	National Environmental Policy Act (NEPA) Review
US Army Corps of Engineers	Nationwide 12 Permit (Section 10 of Rivers and Harbors Act and Section 404 of Clean Water Act)
US Fish and Wildlife Service	Letter of Concurrence (under Section 7, Endangered Species Act)
NOAA Fisheries	Letter of Concurrence (under Section 7, Endangered Species Act)
State	
California State Lands Commission (CSLC)	Lease of State Lands
California Coastal Commission (CCC)	Coastal Development Permit Federal Consistency Certification
State Water Resources Control Board	National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activities
California Department of Fish & Game	Letter of Concurrence Section 2090 Interagency consultation Possibly Section 2081 Incidental Take under the California Endangered Species Act
California Department of Parks and Recreation (CDPR) State Historic Preservation Officer	Consultation and Memorandum of Understanding (MOU) (under Section 106 of the National Historic Preservation Act)
Regional/Local	
Air Resources Board or Monterey Bay Unified Air Pollution Control District	Air Quality Authorization
Central Coast Regional Water Quality Control Board	Water Quality Certificate (under Section 401 of the Clean Water Act [CWA])
Northwest Information Center	Consultation and Historic Resources Update
Moss Landing Harbor District	Special Activities Use Permit or similar
Monterey County Planning and Building Department	Building Permit, if necessary